YAKEEN NEET 2.0

2026

Vectors

Physics

Homework Solution 02 (of Lec-08)

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$$|\vec{A}\times\vec{B}| = AB\sin\theta$$

$$|\vec{A}\times\vec{B}| = A\ (\text{Comp}^{n}\text{ of } B \perp^{r} \text{ to } A)$$

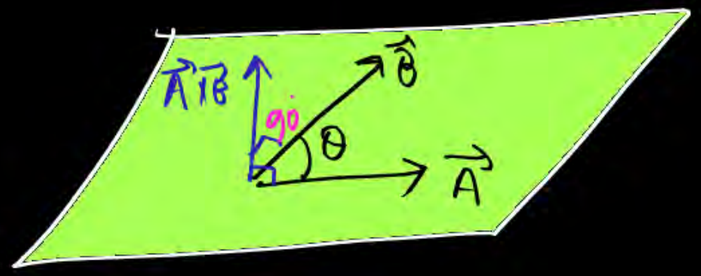
$$\Rightarrow \text{Component of } B \perp^{r} \text{ to } A = \frac{|\vec{A}\times\vec{B}|}{A} \quad \checkmark$$

$$\text{"} \quad \text{"} \quad B \parallel^{r} \text{ to } A = \frac{\vec{A}\cdot\vec{B}}{A} \quad \checkmark$$

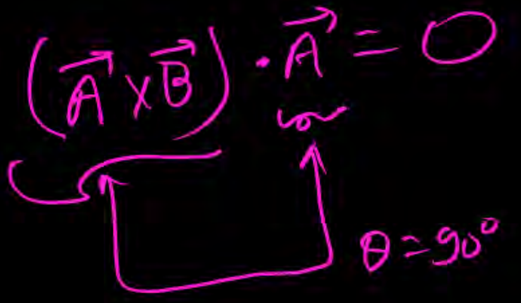
$$\vec{A}\times\vec{B} = AB\sin\theta\,\hat{\eta}$$

$\hat{\eta}$ = dir^{n} of $\vec{A}\times\vec{B}$

Angle b/w $\vec{A}\times\vec{B}$ & $\vec{A}$ = 90



$$(\vec{A}\times\vec{B})\cdot\vec{A} = 0$$



$$(\vec{A}\times\vec{B})\cdot\vec{B} = 0$$

$$\vec{A}\times\vec{B} = -\vec{B}\times\vec{A}$$

$$\vec{A} \times \vec{B} = \begin{vmatrix} i & J & K \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{vmatrix} = i\left(A_y B_z - A_z B_y\right) + \hat{J}\left(A_z B_x - A_x B_z\right) + \hat{K}\left(A_x B_y - A_y B_x\right)$$

Question

The torque of force $5\hat{i} + 3\hat{j} - 7\hat{k}$ about the origin is τ. If the force acts on a particle whose position vector is $2\hat{i} + 2\hat{j} - \hat{k}$ then the value of τ will be: **[NEET 2022]**

1. $11\hat{i} + 19\hat{j} - 4\hat{k}$
2. $-11\hat{i} + 9\hat{j} - 4\hat{k}$
3. $-17\hat{i} + 19\hat{j} - 4\hat{k}$
4. $17\hat{i} + 9\hat{j} - 16\hat{k}$

$$\tau = r \times F = \begin{vmatrix} i & j & k \\ 2 & 2 & -1 \\ 5 & 3 & -7 \end{vmatrix}$$

$$= i(-14-(-3)) + \hat{j}(-5-(-14)) + \hat{k}(6-10)$$

$$= -11i + 9\hat{j} - 4\hat{k}$$

Question

The torque of force $5\hat{i} + 3\hat{j} - 7\hat{k}$ about the origin is τ. If the force acts on a particle whose position vector is $2\hat{i} + 2\hat{j} + \hat{k}$ then the value of τ will be: **[NEET 2022]**

1. $11\hat{i} + 19\hat{j} - 4\hat{k}$
2. $-11\hat{i} + 9\hat{j} - 4\hat{k}$
3. $-17\hat{i} + 19\hat{j} - 4\hat{k}$
4. $17\hat{i} + 9\hat{j} - 16\hat{k}$

$\vec{F} = 5\hat{i} + 3\hat{j} - 7\hat{k}$

$\vec{r} = 2\hat{i} + 2\hat{j} + \hat{k}$

$$\tau = \vec{r} \times \vec{F} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 2 & 1 \\ 5 & 3 & -7 \end{vmatrix}$$

$= \hat{i}(-14 - 3) + \hat{j}(5 + 14) + \hat{k}(6 - 10)$

$= -17\hat{i} + 19\hat{j} - 4\hat{k}$

Question

Find torque ($\vec{\tau} = \vec{r} \times \vec{F}$) of a force $\vec{F} = -3\hat{i} + \hat{j} + 5\hat{k}$ acting at the point $\vec{r} = 7\hat{i} + 3\hat{j} + \hat{k}$. **[AIIMS 2009]**

1. $14\hat{i} - 38\hat{j} + 16\hat{k}$
2. $4\hat{i} + 4\hat{j} + 6\hat{k}$
3. $-14\hat{i} + 38\hat{j} - 16\hat{k}$
4. $-21\hat{i} + 3\hat{j} - 5\hat{k}$

$$\vec{\tau} = \vec{r} \times \vec{F} = \begin{vmatrix} i & j & k \\ 7 & 3 & 1 \\ -3 & 1 & 5 \end{vmatrix}$$

H/W

$$= i(15-1) + j(-3-35) + \hat{k}(7-(-9))$$

$$= 14i - 38j + 16\hat{k}$$

Question

If the angle between the vector $\vec{A}$ and $\vec{B}$ is θ, the value of the product $(\vec{B} \times \vec{A}) \cdot \vec{A}$ is equal to

1. Zero
2. $BA^2 \sin\theta \cos\theta$
3. $BA^2 \cos\theta$
4. $BA^2 \sin\theta$

$(\vec{B} \times \vec{A}) \cdot \vec{A} = 0$

4/ω

Question

Find the torque of force $\vec{F} = 5\hat{\imath} + 3\hat{\jmath} - 7\hat{k}$ about origin if the force acts on the particle whose position vector is $2\hat{\imath} + 2\hat{\jmath} + \hat{k}$. (use torque $= \vec{r} \times \vec{F}$) **[JEE Main 2022]**

1. $11\hat{\imath} + 19\hat{\jmath} - 4\hat{k}$
2. $-11\hat{\imath} + 9\hat{\jmath} - 16\hat{k}$
3. $-17\hat{\imath} + 19\hat{\jmath} - 4\hat{k}$
4. $-17\hat{\imath} + 9\hat{\jmath} + 16\hat{k}$

Question

The angle between vectors $(\vec{A} \times \vec{B})$ and $(\vec{B} \times \vec{A})$ is

1. zero
2. π rad (180)
3. $\pi/4$
4. $\pi/2$

Question

Find the torque about the origin when a force of $3\hat{j}$ N acts on a particle whose position vector is $2\hat{k}$ m. **[NEET 2020]**

1. $6\,\hat{i}$ Nm
2. $6\,\hat{j}$ Nm
3. $-6\,\hat{i}$ Nm ✓
4. $6\,\hat{k}$ Nm

$F = 3\hat{j}$

$\vec{r} = 2\hat{k}$

$\hat{i}\ \hat{j}\ \hat{k}$

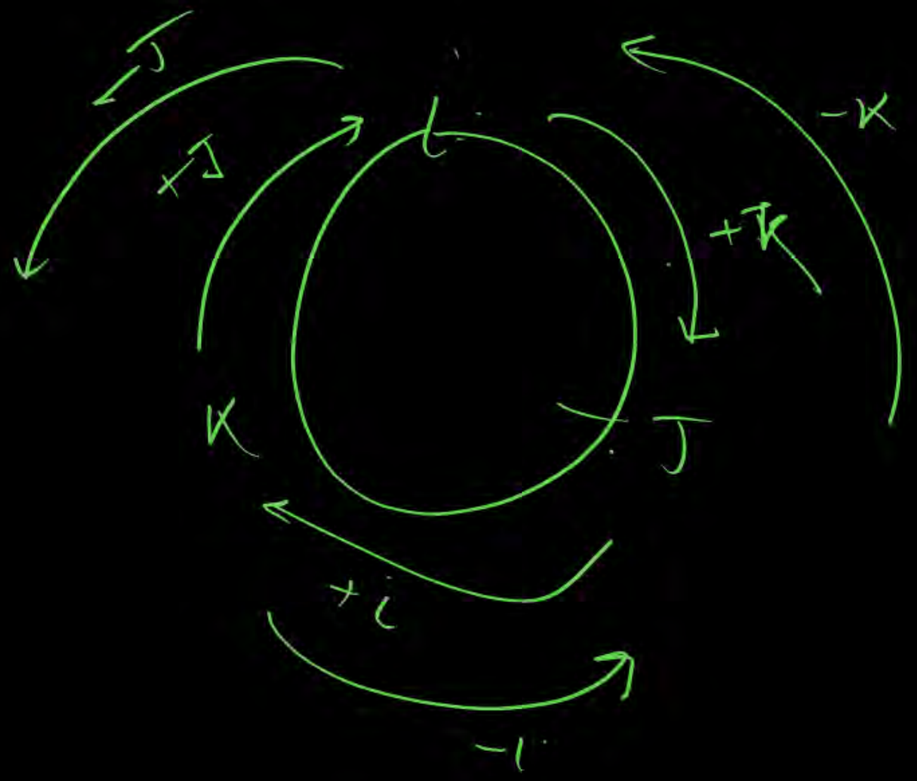
$\tau = r \times F$

$= 2\hat{k} \times 3\hat{j}$

$= 6(\hat{k} \times \hat{j})$

$= -6\hat{i}$

$\hat{i}\,\hat{j}\,\hat{k}\;\hat{i}\,\hat{j}\,\hat{k}\;\hat{i}\,\hat{j}\,\hat{k}$



$\hat{i} \times \hat{j} = k$

$\hat{j} \times \hat{i} = -k$

$\hat{k} \times \hat{j} = -\hat{i}$

$\hat{j} \times \hat{k} = \hat{i}$

$\hat{i} \times \hat{k} = -\hat{j}$

$\hat{k} \times \hat{i} = +\hat{j}$

Question

NEET-2021/23

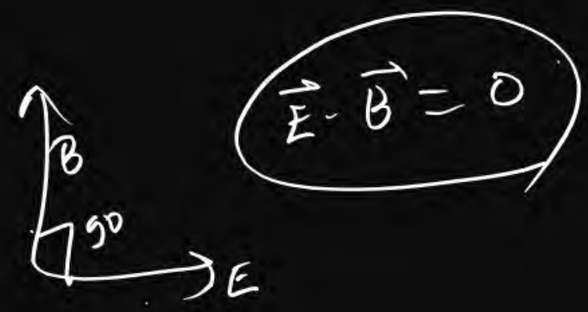
For a plane electromagnetic wave propagation in x-direction, which one of the following combination gives the correct possible directions for electric field (E) and magnetic field (B) respectively?

($E \perp$ to B)

wave $\longrightarrow \hat{i}$

1. $\hat{j}+\hat{k}, \hat{j}+\hat{k}$ — $\vec{E} = \hat{J}+\hat{K}$, $\vec{B} = J+K$
2. $-\hat{j}+\hat{k}, -\hat{j}-\hat{k}$ — $\vec{E} = -\hat{J}+\hat{K}$, $\vec{B} = -J-K$
3. $\hat{j}+\hat{k}, -\hat{j}-\hat{k}$
4. $-\hat{j}+\hat{k}, -\hat{j}+\hat{k}$ — $\vec{E} = -\hat{J}+\hat{K}$, $\vec{B} = -J+K$

$\vec{E}\cdot\vec{B} = 1 - 1 = 0$



Question

Vector $a\hat{i} + b\hat{j} + \hat{k}$ and $2\hat{i} - 3\hat{j} + 4\hat{k}$ are perpendicular to each other when $3a + 2b = 7$, the ratio of a to b is:

1. 1/2
2. 2
3. 3
4. 3/2

takiy dot product

$2a - 3b + 4 = 0$

$2a - 3b = -4$ — (I) × 2

$3a + 2b = 7$ — (II) × 3

$4a - 6b = -8$

$9a + 6b = 21$

$13a = 13$

$a = 1$

Put a in eq (I)

$2 \times 1 + 2b = 7$

$2b = 7 - 3 = 4$

$b = 2$

$\frac{a}{b} = \frac{1}{2}$

Question

If $\vec{F}$ is the force acting on particle having position vector $\vec{r}$ and $\vec{\tau}$ to the torque of this force about origin, then

1. $\vec{r} \cdot \vec{\tau} > 0$ and $\vec{f} \cdot \vec{\tau} < 0$
2. $\vec{r} \cdot \vec{\tau} = 0$ and $\vec{f} \cdot \vec{\tau} \neq 0$
3. $\vec{r} \cdot \vec{\tau} = 0$ and $\vec{f} \cdot \vec{\tau} = 0$
4. $\vec{r} \cdot \vec{\tau} \neq 0$ and $\vec{f} \cdot \vec{\tau} = 0$

$\vec{\tau} = \vec{r} \times \vec{F}$

$\vec{\tau} \cdot \vec{r} = 0$ $\quad \vec{\tau} \perp \vec{r}$

$\vec{\tau} \cdot \vec{F} = 0$ $\quad \vec{\tau} \perp \vec{F}$

Question

Position of particle is given by $\vec{r} = \hat{\imath} + 2\hat{\jmath} - \hat{k}$ and momentum $\vec{p} = 3\hat{\imath} + 4\hat{\jmath} - 2\hat{k}$. The angular momentum is perpendicular to

$L = \vec{r} \times \vec{p}$

1. x-axis
2. z-axis
3. y-axis
4. Line at equal to all three axis

$L = -\hat{j} - 2\hat{k}$ $\quad \vec{r} \times \vec{p} = \begin{vmatrix} i & j & k \\ 1 & 2 & -1 \\ 3 & 4 & -2 \end{vmatrix}$

yz plane

$= i(-4-(-4)) + j(-3-(-2)) + \hat{k}(4-6)$

$= 0 + -j + k(-2) = -j - 2k$

4/11

THANK YOU